Pierce and Kompfner on Earth Satellite Communications Systems

Introduced by JAMES E. BRITTAIN

Editorial Commentary

In this classic paper, John R. Pierce and Rudolf Kompfner of the Bell Telephone Laboratories (BTL) discussed the technical requirements of transoceanic communication by means of passive or active earth satellites. The *Proceedings* editor noted in the "scanning the issue" (called Poles and Zeros) commentary that this paper was being published approximately 101 years after American President Buchanan and Queen Victoria of England had exchanged greetings over the first trans-Atlantic telegraph cable in 1858. The editor noted that the submarine cable had reduced the time required for communication across the Atlantic by a factor of 10^7 and continued that the use of earth satellites seemed to be "an extremely attractive, indeed a revolutionary proposal." Pierce and Kompfner concluded that they had a "great deal of confidence in the over-all feasibility of satellite communications" although considerable research would be needed on active repeaters "before a sufficiently long life can be assured." Their optimism seems to have been justified in view of a published report early in 1984 that fourteen satellites in synchronous orbits now link 109 nations with each satellite having a bandwidth of more than 3000 MHz and a life expectancy of ten years. The next generation of INTELSAT satellites that are scheduled to be deployed beginning in 1986 are to have a capacity of 40 000 telephone circuits and two television channels. For further information see L. Pollack and H. Weiss, "Communications Satellites: Countdown for INTELSAT VI," *Science*, vol. 223, pp. 553–559, Feb. 10, 1984 and Proceedings of the IEEE (Special Issue on Satellite Communication Networks), vol. 72, no. 11, Nov. 1984.

Biographical Sketches

John R. Pierce (1910–) was born in Des Moines, IA, and received the B.S., M.S., and Ph.D. degrees from the California Institute of Technology, Pasadena, in 1933, 1934, and 1936, respectively. He joined the Bell Laboratories in 1936 and was employed there until his retirement in 1971. He made significant contributions to the design of electron guns and high-frequency electronic amplifiers. During the second World War, he worked on klystron tubes and learned of Kompfner's invention of the traveling-wave tube during a trip to England in 1944. He later worked with Kompfner and others at the BTL to improve Kompfner's tube. Pierce published a paper entitled "Orbital Radio Relays" in 1955 two years before the first artificial satellite, the Sputnik, was launched in 1957. His work provided the theoretical basis for the passive satellite Echo launched in 1960 and for the active satellite Telstar in 1962. He received the IRE Morris Liebmann award in 1947, the Edison Medal in 1963, and the IEEE Medal of Honor in 1975. He received approximately 88 patents and has written numerous books and articles. He has written science fiction and poems and has composed computer music. Since retiring from the BTL he has taught at the California Institute of Technology. For further information see *Engineers of Distinction*, p. 239, 1973; *Who's Who in Engineering*, p. 501, 1980; J. R. Pierce, *The Beginnings of Satellite Communications* (San Francisco: San Francisco Press, Inc., 1968); Prescott C. Mabon, *Mission Communications: The Story of Bell Laboratories* (Murray Hill, NJ: Bell Telephone Laboratories, 1975), pp. 71–72.

Rudolf Kompfner (1909–1977) was born in Vienna, Austria, and graduated in architecture from the Technische Hochschule in Vienna in 1933. He went to England in 1934 and worked as an architect with an avocational interest in radio. He was interned briefly when the War began but was released to become a participant in research on high-frequency vacuum tubes at the University of Birmingham. He conceived the traveling-wave tube principle in 1942 and reduced it to practice the following year. He continued his research at Oxford University where he received a doctorate in 1951. The same year he came to the United States to work with J. R. Pierce at the BTL and remained there until his retirement in 1973. He received the David Sarnoff Award from the IRE in 1960 and the IEEE Medal of Honor in 1973. In addition to his work on

James E. Brittain is with the School of Social Sciences, Georgia Institute of Technology, Atlanta, GA 30332, USA.

microwave tubes he did research on laser communication systems and received approximately 55 patents. After his retirement from Bell he taught at Stanford University and at Oxford. For further information see *Who's Who in Engineering*, p. 300, 1977; Obituary in the *Institute*, p. 12, January 1978; Rudolf Kompfner, *The Invention of the Traveling-Wave Tube* (San Francisco: San Francisco Press, 1964); Rudolf Kompfner, "The Invention of Traveling Wave Tubes," IEEE TRANSACTIONS ON ELECTRON DEVICES, vol. ED-23, pp. 730–738, July 1976.